

# SINCLUS

From all at the  
SINCLAIR COMPUTER  
USERS SOCIETY

Enjoy the Holidays  
and best wishes in the  
!NEW YEAR!

Nov/Dec 86

Vol. U: No. 1

# NEWS

SINCLAIR COMPUTER USERS SOCIETY

1229 Rhodes Road

Johnson City, New York 13790

This being our November/December issue, let me wish all "Seasons Greetings", "Happy New Year-1987", being that it is mid-October as I write this, "Happy Halloween", too!

As I'm passing out the best wishes and all, this issue marks the start of our F I F T H year!- How about that folks!

From Secretary's Notes: our September and October meets were very light in attendance. Due to a malfunction in the TV at the last meet no video was available, but no one had any demos.

A tape from the Cleveland User group arrived, and a swap tape of our material is being put together. As their tape was about 3x ours, a second tape of our efforts, perhaps Spectrum material could be on the second tape?? Help in this project would be appreciated. Hal Sohn is making backup copies of these tapes and they will be available from the library at the Nov. meet.

Any member wishing to demo software or hardware at upcoming meets contact, me, Gary or John or just bring it along and we'll help you demo. Anyone with ideas for discussion, projects or just questions contact club officers, by phone or at the next meets.

Same on material for the newsletter, and all you corresponding members--correspond!

President: John Sims.....(607)754-1427 Endwell

Vice-President: Gary Ennis.....(607)687-0698 Owego

Secretary: Paul Hill.....(607)798-7219 Johnson City

Next meet dates: still the third Wednesday of the month.

----- November 19 and December 17 -----

7pm- TV Room

Vestal Public Library

Vestal Parkway, Vestal NY

We are in the same room, same time, and the third Wednesday of each month thru all of 1987.

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New, News, Views and Reviews-----

by Paul Hill

NEW: SPECTERM-64 Telecommunication software and the Z-SI/O Interface card have been released. Info via "Time<x>Press" on the "Average Remote RBBS" at (213) 325-0213.

Ed Gray of the Grey & Clifford Computer Products Co. describes the Specterm 64 as a terminal program which runs on a Spectrum emulated TS2068. As yet the TS2068 version is NOT available. The Specterm 64 has 64 column display, is used with a Westridge 2050 modem at 300 baud. With minor modification you can use Specterm with your Sinclair microdrives. This software uses Xmodem protocol to transfer files. It has full/half duplex, CAPS LOCK/lower case, and open/close buffer toggles. The software can transmit all control characters including ESC. It has X-on/X-off and has a 35K+ buffer. Specterm 64 is very, VERY easy to use. With 2 keystrokes you can save to tape any BASIC, MC or Text that you may have in the buffer. With 2 keystrokes you can transmit or receive any type of file out of or into the buffer using Xmodem protocol. Xmodem is an error checking system that insures successful file transfers. Specterm 64 also sends and receive files in ASCII text. The Specterm 64 "useable" Basic area makes the software easy to configure for most any mass storage hardware that you maybe using. Extensive documentation is provide to enable you to modify this software to suit your particular hardware needs. It comes with a version configured to run with our Z-SI/O card. Software price is \$30.00 plus \$2 S&H in USA(Canada add \$2.-US funds)

NEW: The Z-SI/O card is simply the very best RS232C card available for the TS2068 computer. It can be used for most anything that any other system uses RS232 for. It can be used to drive a printer or a platter. It can be used to connect a Hayes compatible 1200 baud modem to your TS2068. The Z-SI/O card is built in the tradition of the Z-Link cards(by Clifford and Assoc.), which became the Timex standard of quality and support. The Z-SI/O card comes with a 25 page manual and software listings that will enable you to get started immediately. The Z-SI/O card has all 64 contacts of the TS2068 expansion buss feed through so you can connect any additional hardware behind it. The RS232C connector is the real thing a DB25 Pin. The Z-SI/O card has a 90 day limited warranty and out of warranty repairs will be available. Retail price of the Z-SI/O card is \$75 plus \$3.50 S&H in the USA and in Canada add \$2. US Funds.

----->Introductory offer<-----  
 Specterm 64 software and the Z-SI/O RS232C card when ordered together cost \$100.00, including shipping in the USA, in Canada \$105.00 US Funds. ....FOR A LIMITED TIME ONLY... Send check or MO(ship after check clears) to Ed Gray or Dave Clifford, and mail to:

G&C Computer Products  
 PO Box 2186  
 Inglewood, CA 90305  
 Phone: 213-759-7406 or 516-6648

NEWS: From FAMILY COMPUTING, November 1986, page 48, from the "Orphans" column, by Patrick Spera- a TS1000 user gets a chuckle from people who are amazed to find him using one! He writes a column to support us orphans-Adams, TI, and us TS users.  
He also included a note for the TS2068 Technical Manual-\$25 for 2 POUNDS of print with many of the errors corrected-write to Time Designs Magazine, 29722 Hult Rd., Colton, OR 97017 for a copy and for \$15, get the TIME DESIGNS magazine mailed to your address 6 times a year. It is improving with age! If you saw it two years ago, you wouldnt recognize it today-subscribe now!

VIEWS: Two businesses-RAMEX(also called Foundation systems) and EMC(English Micro Connection) are no longer serving the buying users of 2068s/Spectrums/QLs. We had many times in the past carried word of what EMC carried, and I recall one paid ad from Bob Dyl. When our members were getting poor service with EMC we stopped recommending his services. Our last issue carried a warning to all about doing business with Dyl, and we mailed this to Dyl with no response to date. RAMEX had a record of slow service with our members going back to 1984. Dyl left several of our people holding the bag! And I have read of accounts that Ramex/Foundation declared bankruptcy and another computer outlet has opened up at their mailing address. At least one person got rooked with the RAMEX deal. This is a poor situation all away around. We are concerned with the buyer-and we will continue to warn our members of businesses that are giving members the run around, and once warned you proceed on your own terms. Buy from a retailer you or your friends have had good past expiriences with. Order using postal money orders, they usually clear immediately, verses a couple weeks for a personal check.

NEWS: NEW: Latest catalog from E. A. Bown Co. 3404 Pawnee Dr., Alexandria, MN 56308 Tel: (612) 762-8847 Brown is carrying the TS products, and also the Atari ST, C64, IBM PC, Sanyo and Adam. Some NEW (to this kid) stuff: TS2068 SmarText a word proc/data base-\$39.95; Timachine(basic to machine code compiler)-\$19.95; WorkX(a sidekick type program)-\$19.95; Compuserve-(5 hours)- \$18.95; lots more-write for the E11 catalog if you havent got it

QL NEWS UPDATE-----QL NEWS UPDATE-----QL NEWS UPDATE  
NEWS from A+ Computer Response, 69 B Island Street, Keene, NH 03431  
Tel: (603) 357-1800; GROUP DISCOUNT PURCHASE PROCEDURES:  
One contact person per shipment for ordering or requesting technical support.  
One Shipping address.  
One Check/money order  
\$7 per kit for shipping and handling. (\$15 for Canada)  
Individuals may purchase single kits at \$139 plus shipping & handling.  
Credit card users add 4%

NEWS from LISTing, LIST Group, PO Box 438, Centerport, NY 11721-0438:  
Members in the LIST group interested in getting in on a user group purchase, are getting the QL kit for \$109 plus S&H, and are going in with the CATS group and Triangle UG. If you have a firm committment to buy a kit, contact Doug Dewey, ASAP, by letter so he can negotiate a price on behalf of all. Write Doug Dewey, 206 James St. Carboro, NC 27510. There has been NO interest at the Sept and Oct meets of SINCUS on this.

**CTM(used to be Computer Trader Magazine) sent Oct '86 issue along as a sample, first one I have seen, and I think I've been missing a big supporter of TS computers, subscribe \$18/yr, 12 issues to: CTM Circulation, 1704 Sam Drive, Birmingham, AL 35235-ham radios and Sinclairs!**

NEWS from A+ Computer Response, CLOSE OUT on TS1000 programs! -  
Price \$1 a program, minimum order 5 programs, deadline Oct 25 -well,  
I got this the 22nd of Oct, if interested contact them at the above  
address; list of titles VuCalc-Backgammon-Chess- Cube-Stock  
Analyzer-Mixed Game Bag-Money Analyzer-Coupon Organizer-Super Math-The  
Organizer-Flight Simulator. First come first serve.

NEWS: From the Sept issue of the Indiana STUB Newsletter-need wafers?  
for your A&J 2000s or Damco? Try office supply stores that handle  
Smith-Corona may have wafer tapes, 2 for \$8 and format at about 71K.  
Large Service Merchandise Stores also carry them. You save postage  
and handling charges. For those using Mterm in Spectrum mode, the  
print buffer program for Mterm in Spectrum mode wont work unless you  
have POKEd 54554, 207 and 54555, 255. So on exiting Mterm you return  
to the program area. 1STUB BBS (317)898-3903 -24 HOURS 7 DAYS A WEEK!  
SYSOPS-WILLIE JONES.

NEW: "Psion Organiser II": From Curry Computers, PO Box 5607, Glendale,  
AZ 85312-5607 Tel: (602)978-2902 A handheld calculator like computer,  
battery operated, display is LCD dot matrix, 2 lines x 16 characters.  
Interface (RS232) capabilities, memory paks, ROM and RAM, a calculator,  
filing cabinet, alarm clock, calendar, address book, diary and a  
computer. Basic price \$199.95 also new prices on the QL, write for  
price list/catalog.

NEW: "AccDRAW T2": From Glenn Technics, Brookhurst Station, Box 2760,  
Anaheim CA, 92804., \$19.95 (post inc), offers the user a drawing tool  
with some drafting capabilities, rubber-banding elements, two undo  
functions, color control, and scaled dimension readouts, 2 speed  
cursor control driven via joystick or mouse. 2 display files  
available, and may be paged. Aerco- Epson print driver supported, and  
AccuDRAW drawings are compatible with other graphic editors for the  
TS2068.

NEWS: Knighted Computers, 707 Highland St., Fulton, NY 13069  
(315)593-8219 obtained some of EMC's stock. Write or Call Joe or Ray  
Paine for info and prices-lots a QL stuff!

NEW: "Tourist C": The Widjup Co. 1120 Merrifield S.E., Grand Rapids,  
MI 49507- for \$32.50 (inc P&H) and it is an extended bank switching  
disassembler and SPY program residing in BASIC. It uses MC locations  
above "COPYUP" in machine stack. To convince you of the great features  
of this program, send us no more than 60 bytes of any code you like  
and BASE, The Widjup Co. will return a disassembly of that code and  
more info about Tourist C. How's that for bait, try it.

NEW: Hi-RES game for the TS1500, 24K game, all machine code, write for  
catalog, \$24.95 for game, Fred Nachbaur, C-12 MTN. STN. Group Box,  
Nelson BC V1L 5P1 Canada. Version V1 for TS1500 + 8K Hunter NVM or V2  
for TS1500 + 16K RAM. Or see ad in Sep/Oct Time Designs, page 14.  
ZX81/1000 V3 coming soon.

NEW: "Byte Power Magazine": From Byte Power, 1748 Meadowview Ave.  
Pickering, Ontario, Canada L1V 3B8- on cassette tape. 130 programs a  
year, many MC, on tape ready to load. 1 year, 12 issues-\$49.99, sample  
issue is \$5.50.(US)

NEW: "The WORX!": From Novelsoft, 106 Seventh St., Toronto, Ontario,  
Canada M8V 3B4 Tel: (416) 259-8682 for \$19.95 +\$3 S&H, is a



|               |       |          |   |
|---------------|-------|----------|---|
| PRTPATCH.DOC  | 2688  | 08-06-85 | ALTER MTERM TO USE AERCO CENTR.<br>I/F      |
| README.DOC    | 768   | 08-09-85 | TIMEX FILE DIRECTIONS                       |
| SINCUSIV3.LST | 5760  | 06-14-86 | A Phrasebook of Computere                   |
| TASTERM.DOC   | 5760  | 08-06-85 | TIMEX MTERM BUFFER TEXT FROM<br>TASNORD TWO |
| TICTAC2.BAS   | 8704  | 07-27-86 | Trad. Game - Xmodem                         |
| TICTACTO.BTS  | 17792 | 03-20-86 | GAME for TIMEX directory                    |

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Thanks for the input John and for your help getting me and my modem going.

.....CLONE.....CLONE.....CLONE.....CLONE.....CLONE

Here is the easiest way to make backup copies of your expensive or favorite hard to get originals. With CLONE you can duplicate TS2068, SPECTRUM or your own software. You can choose either the one or two tape recorder method. It has a header reader to aid you in transferring programs to disc or microdrive or tape. It simply works! Got a sophisticated copy protected Spectrum program? With CLONE on your TS2068 (used as a noise filter and pulse stretcher) and two tape recorders, you can make acceptable backup copies. Don't have two recorders? Use the Block copy method. This should be in your TS2068/Spectrum program library, and take the guess work out of making backups for that expensive tape. It has been on the market for near two years. It works! ....for members we offer CLONE to you for \$6, postage included. Make check payable to SINCUS. Write care of this newsletter.....for non-members CLONE is available thru the fine vendors listed below, check with them for price.....SINCUS will backup every sale with user support-any question or problem will be answered as quickly as possible.

|                  |                |                |
|------------------|----------------|----------------|
| RMB Enterprises  | Cleveland TSUG | Triangle TSUG  |
| 1419 1/2 7th St. | c/o Al Gedris  | c/o Doug Dewey |
| Oregon City, OR  | 355 Royal Oak  | 206 James St.  |
| 97045            | Richmond Hts.  | Carrboro, NC   |
|                  | Ohio, 44143    | 27510          |

...CLONE....CLONE....CLONE.....CLONE.....CLONE...

# HOBBS

from  
**PHOENIX PETE**

Write to 21st Century Electronics, 6813 Polk St.,  
Guttenburg, NJ ) 07093 Attn Bill Stoacher; send  
him a BASE and ask for his prices on IS stock.  
Tell him where you read this!

|                       | Average Remote | (213) 325-0213 | 8, 1, N | 24Hrs |  |  |   |   |   | 200 S/S | 300 S/S | 400 S/S | 500 S/S | 600 S/S | 700 S/S | 800 S/S | 900 S/S | 1000 S/S | Total System Capacity | Total Yrs Downside | Total CMR Downside |                            |
|-----------------------|----------------|----------------|---------|-------|--|--|---|---|---|---------|---------|---------|---------|---------|---------|---------|---------|----------|-----------------------|--------------------|--------------------|----------------------------|
| BILL'S<br>OBSESSION   |                | (404) 377-2550 | 8, 1, N | 90Z   |  |  | Y | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 21 MB              | 2                  | Los Angeles,<br>California |
| COMPUSERVE            |                | (Local No.)    | 7, 1, 0 | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 300 KB             | 2                  | Atlanta,<br>Georgia        |
| FMUG                  |                | (817) 540-4183 | 8, 1, N | 24Hrs |  |  | Y | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 44 MB              | 25-30              | Columbus,<br>Ohio          |
| ISTUG                 |                | (317) 898-3903 | 7, 1, 0 | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 64K                | 0                  | Ft. Worth,<br>Texas        |
| 10MNY BIN!            |                | (619) 390-9470 | 7, 1, 0 | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 562 KB             | 0                  | Indianapolis,<br>Indiana   |
| MCI NATL              |                | (Telenet)      | 8, 1, N | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 0                  | 0                  | San Diego,<br>California   |
| SIGHT OWL             |                | (312) 459-5721 | 8, 1, N | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 7 MB               | 0                  | Wash, D.C.                 |
| OMNI-NET              |                | (718) 837-2881 | 8, 1, N | 24Hrs |  |  | Y | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 300                | 150                | Chicago,<br>Illinoise      |
| OMEGA FREE<br>ACADEMY |                | (607) 754-3420 | 8, 1, N | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 0                  | 0                  | New York                   |
| PLINK                 |                |                |         | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 0                  | 0                  | New York                   |
| SERIAL PORT           |                | (313) 286-0145 | 8, 1, 0 | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 15 MB              | 7/9                | Ann Arbor,<br>Michigan     |
| SOURCE                |                | (Telenet)      | 7, 1, 0 | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 0                  | 0                  | McLean,<br>Virginia        |
| STARTEXT              |                | (817) 877-1041 | 8, 1, N | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 0                  | 0                  | Ft. Worth,<br>Texas        |
| TIMECHANGE            |                | (213) 329-3922 | 8, 1, 0 | 24Hrs |  |  | Y | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 25 900 MB          | 20                 | Los Angeles,<br>California |
| TSU                   |                | (216) 327-1099 | 7, 1, 1 | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 800 100 KB         | 0                  | California                 |
| VSYS                  |                | (201) 527-0535 | 7, 1, N | *     |  |  | Y | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 0                  | 0                  | Cleveland,<br>Ohio         |
| ZEBRA SYSTEMS         |                | (718) 625-6220 | 8, 1, N | 24Hrs |  |  | N | Y | Y | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y       | Y        | Y                     | 0                  | 0                  | Elizabeth,<br>New Jersey   |

## TS2068 ROM DISASSEMBLY

by Wes Brzozowski, SINCUS

Here's a nice example of why we'd want to allow two computers to communicate via their RS-232 ports. (See "Can We Talk?", page 20 in this issue. By configuring stream #3, as an RS-232 port, a disassembler (Devpak 3, in this case) was used to "PRINT" a disassembly of the entire Home ROM to a nonexistent printer.

In place of the printer, at the other end of the RS-232 cable, was an IBM PC, which took in all the data and wrote it to a disk file. (It ended up with about 300K of text.) Since the PC has some very powerful file handling and editing capabilities, it's fairly easy to "pretty up" the listing with comments and blank lines, and to do other necessary housekeeping chores. (This is an ongoing job; it's far from done.)

I've added comments that I think will be useful, and a lot more helpful information can be found in "The Complete Spectrum ROM Disassembly", by Dr. Ian Logan And Frank O'Hara, published by Melbourne House. My disassembly is annotated under the assumption that you'll have a copy of their book handy.

Whenever possible, the program is broken up at the same spots it's broken in the Spectrum Disassembly, and if the routine is similar or identical to the Spectrum version, it's so mentioned, and the Spectrum address given. This will aid you in looking up Logan and O'Hara's comments, which describe each routine in rich detail. I've pointed out all places where the TS2068 code differs and these at least are thoroughly commented. Between this and the Spectrum Disassembly, you should get a reasonably complete picture of what is happening.

Although I've tried to make it as easy as possible to compare this to Logan and O'Hara's work, there's one scheme where a change seemed worthwhile. Whenever a system variable is accessed as a displacement from the IX register, they substitute the system variable name. I've chosen to retain the original form of the instruction and put the system variable name in the comment field. This way, if you have routines that change the IX register, you can readily see whether or not you have to change it back before calling a particular ROM routine.

We don't know how much interest there will be in this. It can be expanded (or eliminated!) depending on your response. Please let us know what you think.

At present, SINCUS NEWS gets "first crack" at publishing the disassembly, so it wouldn't be appropriate to honor requests for large portions not yet published here. But if you have questions regarding a particular routine, feel free to let me know, and I may be able to supply small portions of unpublished code. Right now, I'll have to limit such help to dues paying members of SINCUS, as I'm not sure what the response will be.

In the meantime, I hope you'll find these listings useful.

(Ed note: Again much thanks Wes for your continuing help in authoring such a wealth of information. The disassembly is printed in the centerfold so you can remove [no staples please] and three hole punch or as necessary to keep this jewel of info together. To the readers, Wes is now writing for Time Designs Magazine, and is tackling the bank switching theory of the TS2068.)



```

;*****
;# TS2068 ROM Disassembly
;*****

```

```

;Continuation of the error routine at 0008
; Identical to Spectrum at 0053

```

```

;Start here, for Power-On, or RESET
; Identical to Spectrum at 0000

```

```

0000 F3      DI
0001 AF      XOR A          ;Flags a "power up"
0002 11FFFF  LD DE,0FFFF        ;Highest RAM to check
0005 C3310D  JP #0D31          ;Continue power up

```

```

;Here for RST 08. Put up an error message
; Identical to Spectrum at 0008

```

```

0008 2A5D5C  LD HL,(CH_ADD)    ;Save present character address
000B 225F5C  LD (I_PTR),HL    ; before processing the error
000E 1843    JR L0053          ;Continue error processing

```

```

;Here for RST 10. Print Character in A
; Identical to Spectrum at 0010

```

```

0010 C3ED11  JP #11ED
0013 FFFFFFFF DEFB #FF,#FF,#FF ;
0017 FF      DEFB #FF

```

```

;Here for RST 18. Collect present BASIC character in A
; Identical to Spectrum at 0018

```

```

0018 2A5D5C  LD HL,(CH_ADD)
001B 7E      LD A,(HL)

```

```

001C C07D00  L001C CALL #007D      ;Check if it's printable
001F D0      RET NC          ;if it is

```

```

;Here for RST 20. Collect NEXT BASIC character in A
; Identical to Spectrum at 0020

```

```

0020 C07400  CALL #0074      ;Update CH_ADD & get character
0023 18F7    JR L001C
0025 FFFFFF  DEFB #FF,#FF,#FF

```

```

;Here for RST 28. Run Floating Point Calculator
; Identical to Spectrum at 0028

```

```

0028 C31A37  JP #371A        ;To the calculator
002B FFFFFF  DEFB #FF,#FF,#FF
002E FFFF    DEFB #FF,#FF

```

```

;Here for RST 30. Allocate BC locations in the workspace
; Identical to Spectrum at 0030

```

```

0030 C5      PUSH BC
0031 2A615C  LD HL,(WORKSP)
0034 E5      PUSH HL
0035 C32D13  JP #132D        ;Open space

```

```

;Here to process the interrupt. Scans the keyboard &
; updates FRAMES every 1/60 second
; Identical to Spectrum at 0038

```

```

0038 F5      PUSH AF
0039 E5      PUSH HL
003A 2A785C  LD HL,(FRAMES)
003D 23      INC HL
003E 22785C  LD (FRAMES),HL ;Update low 2 bytes of FRAMES
0041 7C      LD A,H
0042 B5      OR L
0043 2003    JR NZ,L0048
0045 FD3440  INC (IY+64)     ;FRAMES+2 - Update third byte
0048 C5      L0048 PUSH BC
0049 D5      PUSH DE
004A C0E102  CALL #02E1      ;Read keyboard
004D D1      POP DE
004E C1      POP BC
004F E1      POP HL
0050 F1      L0050 POP AF
0051 FB      EI
0052 C9      RET

```

```

0053 E1      L0053 POP HL
0054 6E      LD L,(HL)

```

```

0055 FD7500  LD (IY+0),L    ;ERR_NR
0058 ED7B305C LD SP,(ERR_SP) ;Normally ends up with #0EBD from the
; last stack item
005C C35413  JP #1354       ;Continue error processing
005F FFFFFFFF DEFB #FF,#FF,#FF
0063 FFFFFF  DEFB #FF,#FF,#FF

```

```

;Process an MNI. Bug at 006D makes this useless
; Identical to Spectrum at 0066

```

```

0066 F5      PUSH AF
0067 E5      PUSH HL
0068 2A805C  LD HL,(#8C00)
006B 7C      LD A,H
006C B5      OR L
006D 2001    JR NZ,L0070    ;Should be JR Z,
006F E9      JP (HL)

```

```

0070 E1      L0070 POP HL
0071 F1      POP AF
0072 ED45    RETN

```

```

;Increment CH_ADD and retrieve the character it points to
; Identical to Spectrum at 0074

```

```

0074 2A5D5C  LD HL,(CH_ADD)
0077 23      INC HL
0078 225D5C  LD (CH_ADD),HL
007B 7E      LD A,(HL)
007C C9      RET

```

```

;See if character in A is printable. One or more spaces
; are skipped, if not
; SIMILAR to Spectrum at 007D

```

```

007D FE21    CP "!"
007F D0      RET NC
0080 FE0D    CP #0D        ;ENTER
0082 C8      RET Z
0083 FE0C    CP #0C        ;DELETE
0085 C8      RET Z
0086 FE10    CP #10        ;INK control (lowest control character)
0088 D8      RET C
0089 FE18    CP #18        ;greater than TAB control
008B 3F      CCF
008C D8      RET C
008D 23      INC HL        ;Skip over an extra space for each
; control character
008E FE16    CP #16
0090 3801    JR C,L0093
0092 23      INC HL        ;Skip one more for AT & TAB

```

```

0093 37      L0093 SCF
0094 225D5C  LD (CH_ADD),HL
0097 C9      RET

```

```

;*****
;# KEYBOARD SECTION
;*****

```

```

;The "Tokens" Table
; SIMILAR to Spectrum at 0095

```

```

0098 BF      DEFB #BF
0099 524EC4  DEFB "RM",#D+#80 ;RND
009C 494E845 DEFB "INKEY",#9+#80 ;INKEYS
00A0 59A4
00A2 50C9    DEFB "P",#I+#80 ;P1
00A4 46CE    DEFB "F",#N+#80 ;FN
00A6 504F494E DEFB "POIN",#T+#80 ;POINT
00AA D4
00AB 53435245 DEFB "SCREEN",#9+#80 ;SCREEN0
00AF 454EA4
00B2 415454D2 DEFB "ATT",#R+#80 ;ATTR
00B6 41D4     DEFB "A",#T+#80 ;AT
00B8 5441C2  DEFB "TA",#B+#80 ;TAB
00BB 54414CA4 DEFB "VAL",#S+#80 ;VALS
00BF 434F44C5 DEFB "COD",#E+#80 ;CODE
00C3 5441CC    DEFB "VA",#L+#80 ;VAL

```

|      |          |                         |           |      |          |                          |                                      |
|------|----------|-------------------------|-----------|------|----------|--------------------------|--------------------------------------|
| 00C6 | 4C45CE   | DEFB "LE", "M"+880      | ;LEN      | 01BA | 494E5053 | DEFB "INPU", "T"+880     | ;INPUT                               |
| 00C9 | 5349CE   | DEFB "SI", "M"+880      | ;SIN      | 01BE | D4       |                          |                                      |
| 00CC | 434F83   | DEFB "CO", "S"+880      | ;COS      | 01BF | 4C4F41C4 | DEFB "LOA", "D"+880      | ;LOAD                                |
| 00CF | 5441CE   | DEFB "TA", "M"+880      | ;TAN      | 01C3 | 4C4953D4 | DEFB "LIS", "T"+880      | ;LIST                                |
| 00D2 | 4153CE   | DEFB "AS", "M"+880      | ;ASN      | 01C7 | 4C45D4   | DEFB "LE", "T"+880       | ;LET                                 |
| 00D5 | 4143B3   | DEFB "AC", "S"+880      | ;ACS      | 01CA | 50415553 | DEFB "PAUS", "E"+880     | ;PAUSE                               |
| 00DB | 4154CE   | DEFB "AT", "M"+880      | ;ATN      | 01CE | CS       |                          |                                      |
| 00DB | 4CCE     | DEFB "L", "M"+880       | ;LN       | 01CF | 4E4558D4 | DEFB "NEX", "T"+880      | ;NEXT                                |
| 00DD | 4558D0   | DEFB "EX", "P"+880      | ;EXP      | 01D3 | 504F48C3 | DEFB "POK", "E"+880      | ;POKE                                |
| 00E0 | 494EB4   | DEFB "IM", "T"+880      | ;INT      | 01D7 | 5052494E | DEFB "PRIN", "T"+880     | ;PRINT                               |
| 00E3 | 5351D2   | DEFB "SR", "R"+880      | ;SOR      | 01DB | D4       |                          |                                      |
| 00E6 | 5347CE   | DEFB "SG", "M"+880      | ;SGN      | 01DC | 504C4FD4 | DEFB "PLO", "T"+880      | ;PLOT                                |
| 00E9 | 4142B3   | DEFB "AB", "S"+880      | ;ABS      | 01E0 | 5253CE   | DEFB "RU", "M"+880       | ;RUN                                 |
| 00EC | 504545CB | DEFB "PEE", "K"+880     | ;PEEK     | 01E3 | 534156C5 | DEFB "SAV", "E"+880      | ;SAVE                                |
| 00F0 | 49CE     | DEFB "I", "M"+880       | ;IN       | 01E7 | 52414E44 | DEFB "RANDOMIZ", "E"+880 | ;RANDOMIZE                           |
| 00F2 | 5353D2   | DEFB "US", "R"+880      | ;USR      | 01EB | 4F4B495A |                          |                                      |
| 00F5 | 535452A4 | DEFB "STR", "M"+880     | ;STR%     | 01EF | CS       |                          |                                      |
| 00F9 | 434852A4 | DEFB "CHR", "M"+880     | ;CHR%     | 01F0 | 49C6     | DEFB "I", "F"+880        | ;IF                                  |
| 00FD | 4E4FD4   | DEFB "NO", "T"+880      | ;NOT      | 01F2 | 434CB3   | DEFB "CL", "S"+880       | ;CLS                                 |
| 0100 | 4249CE   | DEFB "BI", "M"+880      | ;BIN      | 01F5 | 445241D7 | DEFB "DRA", "M"+880      | ;DRAN                                |
| 0103 | 4FB2     | DEFB "D", "R"+880       | ;DR       | 01F9 | 434C4541 | DEFB "CLEA", "R"+880     | ;CLEAR                               |
| 0105 | 414EC4   | DEFB "AN", "D"+880      | ;AND      | 01FD | D2       |                          |                                      |
| 0108 | 3CB0     | DEFB "<", "="+880       | ;=<       | 01FE | 52455455 | DEFB "RETUR", "M"+880    | ;RETURN                              |
| 010A | 3EB0     | DEFB ">", "="+880       | ;=>       | 0202 | 52CE     |                          |                                      |
| 010C | 3CBE     | DEFB "<>", "="+880      | ;<>       | 0204 | 434F50D9 | DEFB "COP", "Y"+880      | ;COPY                                |
| 010E | 4C494EC5 | DEFB "LIN", "E"+880     | ;LINE     | 0208 | 44454C45 | DEFB "DELET", "E"+880    | ;DELETE                              |
| 0112 | 544845CE | DEFB "THE", "M"+880     | ;THEN     | 020C | 54C5     |                          |                                      |
| 0116 | 54CF     | DEFB "T", "D"+880       | ;TO       | 020E | 4F4E2045 | DEFB "ON ER", "R"+880    | ;ON ERR                              |
| 0118 | 535445D0 | DEFB "STE", "P"+880     | ;STEP     | 0212 | 52D2     |                          |                                      |
| 011C | 44454620 | DEFB "DEF F", "M"+880   | ;DEF FN   | 0214 | 53344943 | DEFB "STIC", "K"+880     | ;STICK                               |
| 0120 | 46CE     |                         |           | 0218 | C8       |                          |                                      |
| 0122 | 4341D4   | DEFB "CA", "T"+880      | ;CAT      | 0219 | 534F554E | DEFB "SOUN", "D"+880     | ;SOUND                               |
| 0125 | 464F524D | DEFB "FORMA", "T"+880   | ;FORMAT   | 021D | C4       |                          |                                      |
| 0129 | 41D4     |                         |           | 021E | 465245C5 | DEFB "FRE", "E"+880      | ;FREE                                |
| 012B | 4D4F56C5 | DEFB "MOV", "E"+880     | ;MOVE     | 0222 | 52455345 | DEFB "RESE", "T"+880     | ;RESET                               |
| 012F | 45524153 | DEFB "ERAS", "E"+880    | ;ERASE    | 0226 | D4       |                          |                                      |
| 0133 | CS       |                         |           |      |          |                          |                                      |
| 0134 | 4F50454E | DEFB "OPEN", "M"+880    | ;OPEN %   |      |          |                          |                                      |
| 0138 | 20A3     |                         |           |      |          |                          |                                      |
| 013A | 434C4F53 | DEFB "CLOSE", "M"+880   | ;CLOSE %  |      |          |                          |                                      |
| 013E | 4520A3   |                         |           |      |          |                          |                                      |
| 0141 | 4B455247 | DEFB "MERG", "E"+880    | ;MERGE    |      |          |                          |                                      |
| 0145 | CS       |                         |           |      |          |                          |                                      |
| 0146 | 54455249 | DEFB "VERIF", "Y"+880   | ;VERIFY   | 0227 | 42485936 | DEFB "BMY6"              |                                      |
| 014A | 46B9     |                         |           | 0228 | 35544756 | DEFB "STGV"              |                                      |
| 014C | 424545D0 | DEFB "BEE", "P"+880     | ;BEEP     | 022F | 4E4A5537 | DEFB "NJU7"              |                                      |
| 0150 | 43495243 | DEFB "CIRCL", "E"+880   | ;CIRCLE   | 0233 | 34524643 | DEFB "ARFC"              |                                      |
| 0154 | 4CC5     |                         |           | 0237 | 4D4B4938 | DEFB "MK18"              |                                      |
| 0156 | 494ECB   | DEFB "IN", "K"+880      | ;INK      | 023B | 33454458 | DEFB "JEDK"              |                                      |
| 0159 | 50415045 | DEFB "PAPE", "R"+880    | ;PAPER    | 023F | 0E4C4F39 | DEFB "LO9"               |                                      |
| 015D | D2       |                         |           | 0243 | 3257535A | DEFB "2WS2"              |                                      |
| 015E | 464C4153 | DEFB "FLAS", "M"+880    | ;FLASH    | 0247 | 20095030 | DEFB " " , 80D, "PO"     |                                      |
| 0162 | C8       |                         |           | 024B | 315141   | DEFB "10A"               |                                      |
| 0163 | 42524947 | DEFB "BRIGH", "T"+880   | ;BRIGHT   |      |          |                          |                                      |
| 0167 | 48D4     |                         |           |      |          |                          |                                      |
| 0169 | 494E5645 | DEFB "INVERS", "E"+880  | ;INVERSE  |      |          |                          |                                      |
| 016B | 5253C5   |                         |           |      |          |                          |                                      |
| 0170 | 4F5645D2 | DEFB "OYE", "R"+880     | ;OVER     | 024E | E3C4E0E4 | DEFB "E3, 8C4, 8E0, 8E4  | ;READ, BIN, LPRINT, DATA             |
| 0174 | 4F35D4   | DEFB "OUT", "T"+880     | ;OUT      | 0252 | B4BC8D8B | DEFB "84, 8BC, 8DD, 8DB  | ;TAN, SGN, ABS, SQR                  |
| 0177 | 4C505249 | DEFB "LPRIN", "T"+880   | ;LPRINT   | 0256 | AFB0B1C0 | DEFB "8F, 8B0, 8B1, 8C0  | ;CODE, VAL, LEN, USR                 |
| 017B | 4ED4     |                         |           | 025A | A7A8BEAD | DEFB "87, 8A6, 8BE, 8AD  | ;PI, INKEY%, PEEK, TAB               |
| 017D | 4C4C4953 | DEFB "LLIS", "T"+880    | ;LLIST    | 025E | B2BAE5A5 | DEFB "82, 8BA, 8E3, 8A5  | ;SIN, INT, RESTORE, RND              |
| 0181 | D4       |                         |           | 0262 | C2E183B9 | DEFB "8C2, 8E1, 8B3, 8B9 | ;CHR%, LLIST, COS, EXP               |
| 0182 | 53344FD0 | DEFB "STO", "P"+880     | ;STOP     | 0266 | C1B8     | DEFB "8C1, 8B8           | ;STR%, LN                            |
| 0186 | 524541C4 | DEFB "REA", "D"+880     | ;READ     |      |          |                          |                                      |
| 018A | 444154C1 | DEFB "DAT", "A"+880     | ;DATA     |      |          |                          |                                      |
| 018E | 52455354 | DEFB "RESTOR", "E"+880  | ;RESTORE  |      |          |                          |                                      |
| 0192 | 4F52C5   |                         |           | 0268 | 7EDCDA5C | DEFB "87E, 8DC, 8DA, 85C | ;FREE, BRIGHT, PAPER, \              |
| 0195 | 4E45D7   | DEFB "NE", "M"+880      | ;NEW      | 026C | B77B7DD8 | DEFB "87, 87B, 87D, 8DB  | ;ATN, ONERR, SOUND, CIRCLE           |
| 0198 | 424F5244 | DEFB "BORDE", "R"+880   | ;BORDER   | 0270 | BFAEAAA8 | DEFB "8F, 8AE, 8AA, 8AB  | ;IN, VAL%, SCREEN%, ATTR             |
| 019C | 45D2     |                         |           | 0274 | DDDED7F7 | DEFB "8D, 8DE, 8DF, 87F  | ;INVERSE, OVER, OUT, RESET           |
| 019E | 434F4E54 | DEFB "CONTINU", "E"+880 | ;CONTINUE | 0278 | B5D67C05 | DEFB "85, 8D6, 87C, 8D5  | ;ASN, VERIFY, STICK, MERGE           |
| 01A2 | 494E55C5 |                         |           | 027C | 5DBB86D9 | DEFB "85D, 8DB, 886, 8D9 | ;], FLASH, ACS, INK                  |
| 01A6 | 4449CD   | DEFB "DI", "M"+880      | ;DIM      | 0280 | 58D7     | DEFB "85B, 8D7           | ;I, BEEP                             |
| 01A9 | 5245CD   | DEFB "RE", "M"+880      | ;REN      |      |          |                          |                                      |
| 01AC | 464FD2   | DEFB "FO", "R"+880      | ;FOR      |      |          |                          |                                      |
| 01AF | 474F2054 | DEFB "GO T", "D"+880    | ;GO TO    |      |          |                          |                                      |
| 01B3 | CF       |                         |           |      |          |                          |                                      |
| 01B4 | 474F2053 | DEFB "GO SU", "D"+880   | ;GO SUB   | 0282 | 0C070604 | DEFB "80C, 807, 806, 804 | ;DELETE, EDIT, CAPS LOCK, TRUE VIDEO |
| 01B8 | 55C2     |                         |           | 0286 | 05080A08 | DEFB "805, 808, 80A, 80B | ;INV VIDEO, c left, c down, c up     |
|      |          |                         |           | 028A | 090F     | DEFB "809, 80F           | ;c right, GRAPHICS                   |

The Keyboard Data Tables. Used to convert a keypress to an actual ASCII character or token identical to Spectrum at 0205

The Character Table

E mode, No Shift

E mode, Shift Pressed

Caps Shift & Number key

;Symbol Shift & Letter Key

```
028C E22A3FCD DEF8 0E2,02A,03F,0CD ;STOP,0,?,STEP
0294 AC2D2B3D DEF8 0AC,02D,02B,03D ;AT,-,+,#
0298 2E2C3B22 DEF8 02E,02C,03B,022 ;. , ;
029C C73CC33E DEF8 0C7,03C,0C3,03E ;<=>,<,>
02A0 C52FC960 DEF8 0C5,02F,0C9,060 ;OR,/,<,>
02A4 C63A DEF8 0C6,03A ;AND,;
```

;E mode, Symbol Shift, & Number Key

```
02A6 D0CEABCA DEF8 0D0,0CE,0AB,0CA ;FORMAT,DEF FN,FN,LINE
02AA D3D4D1D2 DEF8 0D3,0D4,0D1,0D2 ;OPEN#,CLOSE#,MOVE,ERASE
02AE A9CF DEF8 0A9,0CF ;POINT,CAT
```

;Keyboard Scanning Routine  
; Identical to Spectrum at 028E

```
02B0 2E2F LD L,02F
02B2 11FFFF LD DE,0FFFF
02B5 01FEFE LD BC,0FEFE

;Loop 8 times - once for each five keys
02B8 ED78 L02B8 IN A,(C)
02BA 2F CPL
02BB E61F AND 01F
02BD 280E JR Z,L02CD ;If none of these 5 are being pressed

02BF 67 LD H,A
02C0 7D LD A,L

02C1 14 L02C1 INC B
02C2 C0 RET NZ ;If the dummy at the keyboard is
; holding down too many keys

;Keep subtracting 8 until we find a keypress
02C3 D608 L02C3 SUB 008
02C5 C03C SRL H
02C7 30FA JR NC,L02C3

02C9 53 LD B,E
02CA 5F LD E,A ;Save older keypress
02CB 20F4 JR NZ,L02C1 ;If more than one key pressed

02CD 2B L02CD DEC L
02CE CB00 RLC B ;Update counter
02D0 38E6 JR C,L02B8 ;If all 8 loops not done
```

;Handle all allowable multiple keypresses

```
02D2 7A LD A,D
02D3 3C INC A
02D4 C8 RET Z
02D5 FE28 CP 028
02D7 C8 RET Z
02D8 FE19 CP 019
02DA C8 RET Z
02DB 78 LD A,E
02DC 5A LD E,D
02DD 57 LD D,A
02DE FE18 CP 018
02E0 C9 RET
```

;Main Keyboard Routine. CALLED by Interrupt Handler  
; Almost Identical To Spectrum At 028F

```
02E1 CDB002 CALL 002B0 ;Keyboard scan
02E4 C0 RET NZ

02E5 21005C LD HL,K_STATE

02E8 CB7E L02E8 BIT 7,(HL)
02EA 2007 JR NZ,L02F3
```

```
02EC 23 INC HL
02ED 35 DEC (HL)
02EE 2B DEC HL
02EF 2002 JR NZ,L02F3

02F1 36FF LD (HL),0FF
```

```
02F3 78 L02F3 LD A,L
02F4 21045C LD HL,K_STATE + 4
02F7 B8 CP L
02F8 20EE JR NZ,L02E8
```

```
02FA C05C03 CALL 0035C ;Get value of key being pressed
02FB D0 RET NC
```

```
02FE FDC830AE RES 5,(IY+4B) ;FLAG52 - Reset repeat of DELETE key
0302 21005C LD HL,K_STATE
0305 BE CP (HL)
0306 282E JR Z,L0336
```

```
0308 EB EX DE,HL
0309 21045C LD HL,K_STATE + 4
030C BE CP (HL)
030D 2827 JR Z,L0336
```

```
030F CB7E BIT 7,(HL)
0311 2004 JR NZ,L0317
```

```
0313 EB EX DE,HL
0314 CB7E BIT 7,(HL)
0316 C8 RET Z
```

```
0317 5F L0317 LD E,A
0318 77 LD (HL),A
0319 23 INC HL
031A 3605 LD (HL),005
031C 23 INC HL
031D 3A095C LD A,(REPPDEL)
0320 77 LD (HL),A
0321 23 INC HL
0322 F0E07 LD C,(IY+7)
0325 F05601 LD D,(IY+1)
0328 E5 PUSH HL
0329 CB7103 CALL 00371 ;Decode keys
032C E1 POP HL
032B 77 LD (HL),A
```

```
032E 32085C L032E LD (LAST_K),A
0331 FDCB01EE SET 5,(IY+1)
0335 C9 RET
```

;Key Repeater  
; SIMILAR to Spectrum at 0310

```
0336 23 L0336 INC HL
0337 3605 LD (HL),005
0339 23 INC HL
033A 3A085C LD A,(LAST_K) ;New
033D FECE CP 0CE ;New
033F D0 RET NC ;New

0340 35 DEC (HL)
0341 C0 RET NZ
```

```
0342 3A0A5C LD A,(REPPER)
0345 77 LD (HL),A
0346 23 INC HL
0347 7E LD A,(HL)
0348 FE0C CP 00C
034A 20E2 JR NZ,L032E
```

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034C FBCB30EE SET 5,(1Y+4B)  
0350 F5 PUSH AF  
0351 01204E LD BC,04E20

0354 0B L0354 DEC BC  
0355 79 LD A,C  
0356 B0 OR B  
0357 20FB JR NZ,L0354

0359 F1 POP AF  
035A 18D2 JR L032E

;Returns With The Value of The Key Being Pressed, Unless  
; It's Only A Shift Key  
; Identical to Spectrum At 031E

035C 42 LD B,B  
035D 1600 LD B,000  
035F 7B LD A,E  
0360 FE27 CP 027  
0362 B0 RET NC  
  
0363 FE18 CP 018  
0365 2003 JR NZ,L036A  
0367 CB78 BIT 7,B  
0369 C0 RET NZ

036A 212702 L036A LD HL,00227  
036B 19 ADD HL,DE  
036E 7E LD A,(HL)  
036F 37 SCF  
0370 C9 RET

;Key Decoder - Produces "real" code from keyscan info  
; Identical to Spectrum at 0333

0371 7B LD A,E  
0372 FE3A CP 03A  
0374 382F JR C,L03A5

0376 0B DEC C  
0377 F8D03 JP N,0038D

037A 2803 JR Z,L037F

037C C64F ADD A,84F  
037E C9 RET

037F 210D02 L037F LD HL,0020B  
0382 04 INC B  
0383 2803 JR Z,L0388

0385 212702 LD HL,00227

0388 1600 L0388 LD B,000  
038A 19 ADD HL,DE  
038D 7E LD A,(HL)  
038C C9 RET

038D 214B02 LD HL,0024B  
0390 CB40 BIT 0,B  
0392 28F4 JR Z,L0388

0394 CB5A BIT 3,B  
0396 280A JR Z,L03A2

0398 FBCB30EE BIT 3,(1Y+4B)  
039C C0 RET NZ

039D 04 INC B  
039E C0 RET NZ

039F C620 ADD A,020  
03A1 C9 RET

03A2 C6A5 L03A2 ADD A,0A5  
03A4 C9 RET

03A5 FE30 L03A5 CP 030  
03A7 D9 RET C

03A8 0B DEC C  
03A9 F8D03 JP N,0038D

03AC 2019 JR NZ,L03C7

03AE 217602 LD HL,00276  
03B1 CB68 BIT 5,B  
03B3 28D3 JR Z,L03B8

03B5 FE38 CP 038  
03B7 3007 JR NC,L03C0

03B9 D620 SUB 020  
03BB 04 INC B  
03BC C8 RET Z

03BD C608 ADD A,008  
03BF C9 RET

03C0 B636 L03C0 SUB 036  
03C2 04 INC B  
03C3 C8 RET Z

03C4 C6FE ADD A,0FE  
03C6 C9 RET

03C7 213202 L03C7 LD HL,00252  
03CA FE39 CP 039  
03CC 289A JR Z,L03B8

03CE FE30 CP 030  
03D0 2886 JR Z,L03B8

03D2 E607 AND 007  
03D4 C680 ADD A,080  
03D6 04 INC B  
03D7 C8 RET Z

03D8 EE0F XOR 00F  
03DA C9 RET

03DB 04 INC B  
03DC C8 RET Z

03DD CB68 BIT 5,B  
03DF 215202 LD HL,00252  
03E2 20A4 JR NZ,L03B8

03E4 D610 SUB 010  
03E6 FE22 CP 022  
03E8 2806 JR Z,L03F0

03EA FE20 CP 020  
03EC C0 RET NZ

03ED 3E5F LD A,05F  
03EF C9 RET

03F0 3E40 L03F0 LD A,040  
03F2 C9 RET

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## WHAT XMODEM CAN SAVE YOU

When considering using XMODEM over standard ASCII file transfer for modem communication it may appear that all of those checksum characters and handshaking signals would slow down your file transfer and add to the transfer time (a real concern with toll calls and connect time charges). With XMODEM those few extra checking characters may save you the time of re-sending the whole file if the first copy had errors. At 300 baud line errors are few and far between but they do occur. When they do it may look like a TYPO or cut off word in a text file. In a Basic Program Listing it could change the meaning of a line and cause the program to fail with incorrect results. If transferring a Basic Program as with MTERM SMART II in HEX MODE, a single error may make the program completely useless, you sometimes cannot even list the program. Using XMODEM for transferring Basic Programs not only insures the data is transferred correctly but actually saves almost 50 percent of the transfer time. In the HEX MODE of transfer, each byte is converted into two ASCII characters therefore to send 1280 bytes require 2560 characters to be transferred. With XMODEM this same file would be sent in 10 blocks of 128 characters and 5 bytes of handshaking and checking characters. In addition to the reduced transfer time, checking is done on each block and any block in error requires only that block to be re-transmitted.

Anyone who is using a modem for should seriously consider investing in an XMODEM program. I am not endorsing any supplier of software, I'm not even sure if more than one exists. What I would like to convey to the users of modems is my reasons for using XMODEM. Most pay services as well as free RBBS S support XMODEM and some will require it for transfer of certain files.

The following information was downloaded from the SUNNY SCHOOL of GENERAL STUDIES RBBS. It explains in general how XMODEM works and how it is easily adaptable to most computers.

### XMODEM File Transfer Protocol

By Larry Jordan

When transferring files between computers using the telephone system, there is always the chance that electrical noise will result in data transmission errors. To ensure proper transfer of files it is necessary to detect data transmission errors and to retransmit data that contains errors. Most people think that asynchronous parity error detection provides that capability. It does not. Parity error detection does tell you when a data transfer error has occurred, but it is up to you to retransmit the data to correct errors. The problem is that parity error detection is not actually performed by most IBM PC communication packages. If a package does perform the error detection, it may not inform you of errors in such a way that you know to immediately retransmit the data. ASCII, for example, places an asterisk in a file where parity errors are detected, but you may not realize the errors occurred until long after the file is transferred. To ensure "error-free" data transfer you need a protocol file transfer technique. Andrew Fluegelman has added such a technique to PC-TALK.III called the XMODEM protocol.

A protocol is a set of rules and conventions that apply to a specific area of communications that allow participants to properly communicate regardless of the hardware brand or software package being used. The protocol file transfer is a set of rules for transferring files which specifies a set of ASCII handshaking characters and the sequence of handshaking required to perform certain file transfer functions. Protocol handshaking signals allow communication software to transfer text, data and machine code files, and to perform sophisticated error-checking. The handicap in using protocol file transfer techniques is that the computers on both ends of the communications link must be using compatible software; there is no standard that controls these protocols and almost all communication packages that have a protocol file transfer option use a protocol unique to that package. This means that a business or group of people must standardize its microcomputer communications software to take

The Ward Christensen XMODEM protocol is one specific file transfer protocol that may become a default standard in personal communications because of its widespread use on bulletin boards and because of its inclusion in low cost personal computer communication packages such as PC-TALK. It has not gained widespread acceptance in business communication packages partly because the protocol is public domain; most business communication package designers use unique protocols to force businesses to use their software on both ends of communication links. By providing you with this insight into protocol transfer and explaining in detail the operation of the XMODEM protocol, I hope to add momentum to the development of a "standard protocol" whether it be the XMODEM model or some other model. Users of communication software deserve a standard protocol that will allow them to use the technique with any microcomputer regardless of the software packages employed.

The XMODEM protocol is illustrated in Figure 1. As you can see from that figure, XMODEM does not begin the transfer of data until the receiving computer signals the transmitting computer that it is ready to receive data. The Negative Acknowledge (NAK) character is used for this signal and is sent to the transmitting computer every 10 seconds until the file transfer begins. If the file transfer does not begin after 9 NAK's are sent, the process has to be manually restarted.

After a NAK is received, the transmitting computer uses a Start of Header (SOH) character and two block numbers (a true block number followed by a 1's complement of the number) to signal the start of a 128-byte block of data to be transferred, then sends the block followed by an error-checking checksum. The checksum is calculated by adding the ASCII values of each character in the 128 character block; the sum is then divided by 255 and the remainder is retained as the checksum. After each block of data is transferred, the receiving computer computes its own checksum and compares the result to the checksum received from the transmitting computer. If the two values are the same, the receiving computer sends an Acknowledge (ACK) character to tell the receiver to send the next sequential block. If the two values are not the same, the receiving computer sends the transmitter an NAK to request a retransmission of the last block. This retransmission process is repeated until the block of data is properly received or until 9 attempts have been made to transmit the block. If the communications link is noisy, resulting in improper block transmission after 9 attempts, the file transfer is aborted.

XMODEM uses two block numbers at the start of each block to be sure the same block is not transmitted twice because of a handshake character loss during the transfer. The receiving computer checks the transmitted block to be sure that it is the one requested and blocks that are retransmitted by mistake are thrown away. When all data has been successfully transmitted, the transmitting computer sends the receiver an End of Transmission (EOT) character to indicate the end of file.

The XMODEM protocol offers the IBM PC several advantages over other protocols and file transfer methods. First, the protocol is in the public domain which makes it readily available for software designers to incorporate into a communications package. Second, the protocol is easy to implement using high level languages such as BASIC or Pascal. Third, the protocol only requires a 256-byte communication receive buffer which makes it attractive for IBM PC owners who only have 64K systems. Fourth, the protocol allows a user to transfer non-ASCII 8-bit data files (i.e., COM, EXE and tokenized BASIC) between microcomputers because it calculates the end of a file based on file size and uses handshake signals to indicate the end of a file instead relying on an end of file marker character (control-Z) to terminate a file transfer. Fifth, XMODEM error-checking is superior to normal asynchronous parity error checking. The parity method of error-checking is 85% effective if the software on the receiving end checks for parity errors. XMODEM error-checking is 99.6% effective, and the software on the receiving end must check for errors. Parity errors detected also do not result in automatic retransmission of the bad data; XMODEM detected errors result in data retransmission until no errors are

detected or until 9 retransmissions have been attempted. Finally, the protocol is used by many CP/M bulletin boards and having the protocol in a communications package allows the IBM PC user to receive error-checked files from these bulletin boards.

Andrew Fluegelman has given the XMODEM protocol a real boost in the IBM PC world by including it in his package. He has also added significant power to the package by including the protocol Rumor has it that Don Withrow will soon add to the XMODEM momentum by adding it to his HOSTCOMM software package. Keep up the good work guys -- we will get a standard one way or the other!

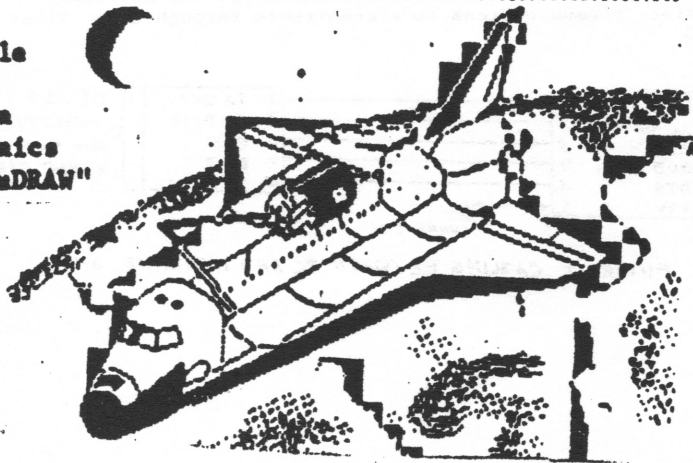
[This article was derived from material contained in a book written by Larry Jordan and Bruce Churchill to be published this Summer by The Brady Company. The article will also be in the 5th issue of PC World magazine.]

XMODEM Protocol File Transfer



Figure 1

sample  
from  
Glenn  
Technics  
"AccuDRAW"



## Can We Talk? On Communicating Computers

by Wes Brzozowski, SINCUS

While there have been reams of information published on various types of interface for the TS2068, the lowly RS-232 port has been almost ignored. This is in spite of the fact that many hardware products contain an RS-232 interface as an "extra", like the Sinclair Interface One, and the Timex Portugal disk drive. In some cases, it's easy to add an RS-232 port (see Time Designs, Mar/Apr 86 for info on adding one to a Westridge modem.)

Although such a port has been widely used for printers, TS2068 users have wisely embraced the Centronics standard, instead. It's also used to connect the modems, but the Westridge plugs directly into the Timex bus, eliminating the need for an RS-232 port there. But there's still another important use that we'll describe in this article.

Communication between different brands of computers can be difficult largely because their busses are different. But even if they're identical, there can still be trouble if they're not designed for communication in the first place. Fortunately, just about every computer has an RS-232 port, and these are perfect to send data between computers that have absolutely nothing else in common!

Why bother? It depends on what type of work you actually do with your computer (or computers in this case). SINCUS wizard Dave Schoenwetter has used a home-made RS-232 port to dump Tasword files into his IBM PC so that they can be run through a spelling checker. Then they'd get sent back. (The file has to be reformatted a bit, since Tasword uses a rather odd layout, but that's a minor problem.)

Another possible use would occur if you had a modem for only one computer, but would like to download a program for the other one. With this you could transfer the code between machines. Elsewhere in this issue, we'll be starting a disassembly of the TS2068 ROMs, which is really only practical (at this quality, on an amateur level) because a rough disassembly could be "dumped" to an IBM PC. The resulting file needed patching up on a major scale, but the powerful handling and editing facilities on that machine made that an almost trivial job.

In the examples shown here, we use an Interface One and an IBM PC or compatible, but the ideas are readily converted for other systems. The hardware chosen here is a "natural", because a number of SINCUS members have one or both of the necessary items. Also, communications is accomplished through a few lines of BASIC.

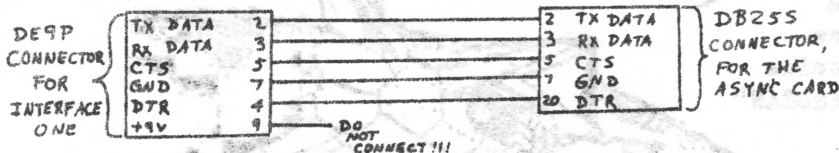


FIGURE 1. CABLING BETWEEN PC AND INTERFACE ONE



Figure 1 shows the necessary cable wiring from the Interface One to a Async card in the PC. The listings shown have the Async configured as the COM1 port, but this is easily changed, if needed.

```
10 OPEN "COM1:300,N,8,1,CS,DS,RS" AS #1
20 INPUT #1,IS
30 PRINT IS
40 CLOSE #1
```

LISTING 1A

```
10 OPEN #4;"#b"
20 FORMAT #4;"#b";300
30 PRINT #4;"Des was here"
40 CLOSE #4
```

LISTING 1B

```
10 OPEN "COM1:300,N,8,1,CS,DS,RS" AS #1
20 INPUT #1,IS
30 PRINT IS
40 GOTO 20
```

LISTING 2A

```
10 OPEN #4;"#b"
20 FORMAT #4;"#b";300
30 LIST #4
40 CLOSE #4
```

LISTING 2B

Listings 1A and 1B show a simple example of PRINTing a string from the TS2068 to the PC, while 2B and 2C show how to LLIST a BASIC program from the TS2068 to the PC.

```
10 OPEN "COM1:300,N,8,1,CS1000,RS" AS #1
20 PRINT #1,"a"
30 CLOSE #1
```

LISTING 3A

```
10 OPEN #4;"#b"
20 FORMAT #4;"#b";300
30 INPUT #4;"a"; PRINT #4
40 CLOSE #4
```

LISTING 3B

Listings 3A and 3B show how to send individual characters from the PC to the TS2068. While the Interface One literature suggests it can receive larger strings, it contains no examples. The book by the British Gurus Ian Logan and Andrew Pennel show only the receiving of individual characters, as well. I've been able to do no better than this, and I suspect that this feature in the Interface One is not so well debugged as we'd like. That's inconvenient, but we can work around it.

```
100 ON KEY(1) GOSUB 10000
200 KEY(1) ON
1000 INPUT "Name of output file ";#0
1020 OPEN "COM1:9600,N,8,1,CS,DS,RS" AS #1
1040 OPEN #0 FOR OUTPUT AS #2
1050 PRINT #2,"*"
1100 LINE INPUT #1,IS
1130 IF LEN(IS)>1 THEN IS=RIGHT$(IS,2);LEN(IS)-1
1140 PRINT #2,IS
1160 GOTO 1100
10000 CLOSE #2;CLOSE #1;STOP
```

LISTING 4

Listing 4 is the program used to dump a "listing" of the ROM disassembly from the TS2068 into a disk file on the PC. We would first OPEN and FORMAT stream #3, so that normal LPRINTing and LLISTing would go to the RS-232 port. We'd then LOAD in the disassembler and a copy of the ROM code, and tell it to send a disassembly to the printer. Of course, there's another computer in place of the printer, but the disassembler neither knows nor cares.

We've given a few specific examples of RS-232 communication here. They're probably not exactly what you need, but they may get you thinking as to how you may put them to use. The possibilities are great, and it's really very simple. Give it a try!

```

10 REM "Shooting Titles"
11 REM
12 REM by Eddie Duncan-Dunlap,
   Bridgend, Mid Glamorgan
13 REM from "Your Sinclair"
14 REM reprinted by "ZX-Appeal
   "-Vancouver Sinclair Users Group
15 REM September 1986
16 REM
20 REM changes to effects-rand
   the x value or drop NOT out of
line 235
21 REM
210 PRINT AT 0,0; INK 7;"Your 6
INCLAIR"
220 FOR x=0 TO 127
230 FOR y=0 TO 7
235 IF NOT POINT (X,y+168) THEN
GO TO 299
240 PLOT 2*x,3*y+80
245 PLOT 0,0: DRAW OVER 1;2*x,3
*y+79
250 PLOT 0,0: DRAW OVER 1;2*x,3
*y+79
255 PRINT AT 21,0;a
265 BEEP .01,7
280 PLOT 2*x,3*y+81
299 NEXT y
300 NEXT x

```

#### WRAP UP

Notice how many NEW items on the first couple pages? Not bad for a computer that has not been produced in two years! I read a most interesting view point in SMUG Bytes, Milwaukee TS Users Group, PO Box 101, Butler, WI 53007-Dave Franson writes "well" of TIMEX, this has to be one of the first NICE articles for that manufacturer. I read of all the nice things that TIMEX did for us and are continuing to do so, and he also patted all TS2068 users on the head for being so smart to buy and use one. I stood in line to put my two cents in for what that nasty watch company did to us and would gladly show them the way to hell. But Dave has a good point, they souped up a Spectrum, got a million interested in computing, and started up a computer market that hasn't quit yet. After using a ZX81, the keyboard does give my fingers exercises I would have never thought of doing. Everything TIMEX started has been improved on like gang busters. Would there be an Aerco Disc drive? or a Digger, or Larken? Are things better or worse for what TIMEX did? In my view, they are pretty good right now and getting better!

Modem users-try GENie- have your Visa/Master Card ready-half duplex call 1-800-638-8369, ENTER HHH, at U# XJM 11933, GENie, C/R: it is \$5 an hour(off prime), \$18 to register

Some interesting articles: PC World November, 1986; page 92:"Hard Knocks for Locks", Software locks lose customers, cure is worse than the disease.  
page 208,"Better than Big Blue" Off-brand PCs;bottom line is getting better daily.  
page218,"Used PC, Oldies but Goodies"-how to buy in the used PC market.

Hello and welcome to new members Esther Greenmun, Binghamton, NY, and Don Waltermann, Sterling Heights, MI, and thank you for the RENEWALS, Myrna McDonald, Greene, NY; Dan Dodway, Kirkwood, NY; Alan Pace, New Milford, PA.

**POLICY**

Local members: meet at 7pm, the third Wednesday of each month, at the Vestal Public Library, Vestal Parkway, next to the McKinley Avenue Bridge. We are in the TV room, East entrance. Bring a friend, family member, open to the public, and the meets are open to all comers. Newsletters from several users groups, old computer magazines available for your use. Dues are \$8 a year, bi-monthly newsletter included.

Corresponding members: We print a bi-monthly newsletter for \$8 a year. We invite you to participate in our forum on any of the Sinclair computers or any other related subject.

Newsletter swaps: We swap with 25 other user groups, and we invite all to use any of our material as long as the author, SINCUS NEWS, date of article and our address is included. All sources of our information are identified, any rumors will be indicated as such.

Advertising: Classified ads for members. One free ad per member per subscription. 10 lines by 32 characters max. Fee is \$2 per non commercial ad, \$3 per commercial ad. Advertising rates for larger ads:

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Material must be camera ready, black and white. We reserve the right to reject any advertiser.

\*\*\*\*\*Emergency Notice\*\*\*\*\*If a SNOW Emergency Travel Advisory is issued by the Broome County Sheriff on the day of our meeting the meeting is automatically cancelled. We will meet at the next scheduled meeting unless there is another snow emergency condition. Dont take chances, save your life, car and ulcer and stay home when in doubt, and we'll see each other next month. Call me after 5pm the day of the meet if there is a question. 798-7219.

-----SINCUS-Sinclair Computer Users Society-----

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From  
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**SINCUS NEWS**  
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